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A VIEW OF THE PHILOSOPHY OF DESCARTES.

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It needs no deep acquaintance with the history of philosophy to discern that the philosophic temper is distinguished by an ardent desire not merely to know, in their isolation, as many facts or theories as idle curiosity or other motives might prompt men to accumulate, but to discover principles that shall give harmony and unity to knowledge. Some germs of this philosophic spirit are probably implanted in the breasts of all men who are capable of allowing their thoughts to rise above the level of mere animal needs, and, as mental culture spreads and deepens, the movements of this spirit are, of course, more widely and deeply felt. It is, however, to Philosophers and Men of Science that we must look for the most eminent examples of it. Though in speaking of Philosophers and Men of Science as if they were distinct classes, it must be borne in mind that, until quite modern times, the philosopher and man of science was almost always found combined in the same person; and if, owing to the vast extension of the domain of science in recent times, it has become necessary for the scientific man to devote himself to some special department, and that, consequently, a distinction is now drawn between him and the philosopher, it is not the temper of mind, but only the extent of the sphere within which that temper seeks its satisfaction, that justifies the distinction. The scientific man takes some circumscribed portion of the great Universe of Mind and Matter wherein to philosophize, of which to discover the unifying principles—the principles which bind his facts together and give them their highest interest and character of intellectual grandeur; the philosopher is content with nothing less than the Universe itself. *Its* unifying principles, *its* rationale, is the great object of *his* aims and desires. Eminent as was Descartes, the illustrious subject for our consideration on this occasion, as a man of science, it is because he aimed at nothing less than a Rationale of the Universe that he has justly earned the title of Philosopher. He was fortunate in the epoch in which it was his lot to publish his philosophical system. The hundred years that preceded its appearance had been distinguished by some of the most remarkable scientific discoveries ever made—discoveries which could not but largely modify the cosmological conceptions that had been handed down by the Greek and scholastic philosophers. The labors of Copernicus had established the heliocentric theory of our planetary system; Galileo's invention of the telescope had revealed the inequalities of the moon's surface, the phases of Venus, the satellites of Jupiter, and the ring of Saturn; the same philosopher, by his experiments on falling bodies, had taken the first steps toward the construction of a sound science of dynamics. The investigation of the laws of the reflection and refraction of light by Maurolycus, Descartes himself, and others, left but little for their successors to discover in an important department of the science of optics. The researches of the professors of the great Paduan school in Italy and Harvey's discovery of the circulation of the blood had revolutionized men's ideas of physiology and anatomy. Queen Elizabeth's physician, Dr. Gilbert, may be said to have constituted a new science by the publication of his great work on the magnet, in which almost all the fundamental facts of magnetism were first made known. The profound impression which these and other marvellous discoveries must have made upon the thoughtful and philosophic minds of the time it would be difficult for us, familiar as we have grown with them, to estimate or even to imagine, had we not witnessed in our own day the depth of the impression and the stimulus to thought produced by Mr. Darwin's speculations on the origin of species. These vast and important additions to knowledge had rendered needful, if not the construction of an entirely new system of philosophy, at least such an extensive modification of the old as would render it consistent with the new discoveries of science. To this necessary task Descartes devoted the chief efforts of his life—a task which his rare intellectual endowments and the variety and extent of his acquirements in philosophy and science rendered him eminently fitted to discharge. The depth and penetration of a profound philosopher were in him united with the keen logical understanding, the lucid style and method, which have distinguished so many of his countrymen. He was familiar with Greek and scholastic philosophy, was one of the most eminent mathematicians of his time, to which science he contributed one of the most valuable, because one of the most fertile and universal, of its methods. He was a scientific investigator himself, besides knowing all the science of his time, the leading facts and principles of which, with a remarkable exception, which will be noticed later on, are to be found embodied in his philosophical writings. Such were the natural gifts and such the acquirements of the philosopher whose system was destined to supersede the old Greek and scholastic systems and form the point of departure for subsequent philosophic speculations.

Let us, then, now inquire what were the new features in Descartes' system of philosophy which distinguish it from the systems of his predecessors, and which enabled his successors to take it as the starting-point of their own speculations. Now, if any one imagines that Descartes made some new and important contribution to the positive solution of the great problems of metaphysics, a careful study of his works, combined with a knowledge of the History of Philosophy, will convince him of his error. By the great problems of metaphysics are meant such problems as, for example, are implied when the questions are asked, Does the soul or mind exist? What is its nature? What its relation to thought and feeling? What is the nature of the material universe, and what its relation to thought? Does God exist? How do we know of His existence, and what is His relation to us? What is reality? What is truth? What the criterion for distinguishing between it and falsehood? On these and the like great questions did Descartes' powerful intellect exercise itself to the end of his life; and the answers he gave to them, the conclusions he reached, had already been given, had already been arrived at by one or other of the philosophers that had preceded him. What, then, did Descartes do to earn the position he holds in philosophy? He did three things. He taught men how to doubt in a rigorous and systematic manner. He brought into clear and distinct view the subjective method in philosophy, made it the foundation of his system, and professed to deduce his theory of the Universe from a self-evident proposition furnished by that method. And, thirdly, taking the widest view of Philosophy, and considering its object to be to furnish a Rationale of the genesis and nature of the Universe, he brought within the circle of his own system almost all the great scientific discoveries of his epoch, whether in the realm of organic or of inorganic nature. In the first place, then, Descartes taught mankind that, ere they can hope to arrive at certainty, they must first learn how to doubt. By precept and example he enforced this difficult, but necessary, lesson upon them. Before his time men had at most merely played at doubting, when they doubted or pretended to doubt at all. He first set them the example of rigorous and systematic doubt, first impressed upon them the necessity of searching out from the inmost recesses of the mind, and submitting to a cautious and vigilant criticism, every belief they had imbibed, whether, almost unconsciously, through the impressions of their senses as they grew up from infancy to manhood—the "*præjudicia ineuntis ætatis*" he so often warns us against—or from the teachings of authority and from the vast mass of unsifted materials stored up in the writings of all ages. It is difficult for us, who have so long and so thoroughly learned this lesson, who are accustomed to submit every proposition in history, philosophy, or science to the rigorous tests suggested by the accumulated experience of the last two centuries of scientific activity—it is difficult for us to realize how little men understood, or rather how entirely they failed to conceive, what thorough and systematic doubt was. Some idea of the depth of their dogmatic slumbers we may form by inspecting the philosophical writings of Descartes' great predecessor, Bacon, one of the most unprejudiced and open-minded of men. What a mass of unexamined dogmatic beliefs does the "Novum Organon" reveal in its writer! what a host of pre-suppositions as to mind, body, the world, forms, essences, and the like, derived from all kinds of sources Greek and scholastic, concerning which the writer seems quite unconscious that all need a rigorous re-examination!

Descartes would, however, have considered that he had conferred on philosophy a boon of little value if the result of his lesson in systematic doubting were to be a barren skepticism. He was himself no skeptic; he believed that there was such a thing as truth; he doubted not the reality of mind and matter; so far was he removed from doubt that, comparing himself to Archimedes, he needed but to find as a fulcrum one fundamental, one indubitable truth, and he would raise into our view the whole system of the Universe. This fulcrum, this irrefragable truth, he believed he had found in his celebrated axiom "*cogito, ergo sum*"—"I think, therefore I am." However doubtful might be the existence, as real objects, of what he saw and felt and heard, he could not doubt their existence as mere sensations; whether his thoughts were true or false, he could not doubt that he had thoughts, and so long as his thoughts, sensations, emotions, volitions, feelings continued their course, so long as the stream of consciousness continued its flow, he could not doubt the continuance of his own existence. Of the existence of his feelings, taken as mere feeling, it was impossible for him to doubt, and, so long as his feelings existed, it was equally impossible to doubt his own existence. "Cogito, ergo sum" was, then, the fundamental self-evident proposition furnished by his subjective method. The thought involved in this sentence, implicit in previous philosophical systems, he rendered explicit, he disentangled it from other ideas, clearly and forcibly explained his method of arriving at it and wherein lay its certainty, and his labors in this matter constitute his second title to the position he holds in the history of philosophy. Now, this truth, *cogito, ergo sum*, not only served as an irrefragable first principle from which his system of philosophy was to start, but, from the exceeding clearness and distinctness with which he apprehended it, it guided him to the discovery of what was equally indispensable with itself—of a criterion or test for distinguishing between truth and falsehood. This criterion is, that whatever is apprehended with the same clearness and distinctness as this primary truth is true likewise. Thus with the discovery of this first truth he had found not only his fulcrum, but his lever too. But, thought Descartes, though my fulcrum needs no guarantee—guarantees itself, in fact—my lever possesses not this perfection; its excellence must be guaranteed by another. Reflecting, therefore, once more on his fundamental truth, *cogito*, *ergo sum*, and observing that he inferred the existence of himself as a thinking substance from the existence of his thoughts, he saw involved in this first principle the further principle, *ex nihilo nihil fit*, or, everything has a cause. The first use he made of this new principle was to prove the existence of God. Among the ideas existing in his mind, he found the idea of a Being infinite, independent, supremely intelligent and supremely powerful—the idea of an all-perfect God. Now, such an idea must have an adequate cause. His own imperfect nature could not possibly be the adequate cause. The only adequate cause could be the actually existing Deity. Moreover, in the idea of God alone was contained necessary and eternal existence; hence there could be no doubt of the existence of this all-perfect Being. God, then, the Creator and Upholder of all things, having been proved to exist, it is from Him we derive our faculty of knowledge; and, as he is a God of perfect truth, it is impossible that he could have given us a faculty that should lead us astray. Whatever, therefore, we perceive clearly and distinctly, must be true. If our ideas are false, it is only when there are obscurity and confusion in them, and then they proceed not from God, but *a nihilo*. In our own breasts, then, we have a criterion for distinguishing between the true and the false—a criterion whose validity is guaranteed by God himself. But though every man possesses this criterion in himself, it depends entirely on his own Will, which Descartes held to be free, whether he make use of this criterion or not. Belief or assent is an act of the Will; it is, therefore, entirely our own fault if we fall into error, since we can always avoid doing so by being careful to give our assent to nothing except to what we clearly and distinctly perceive, and to what can be deduced therefrom by clear and distinct principles of reasoning. So strict is Descartes on this point that he will not allow men to plead the greater imperfection of their intellects as an excuse for falling into greater errors than their fellows. He will not allow of greater or less imperfection of mind. Indeed, he begins his celebrated treatise, "De Methodo," with the words "Nulla res æquabilius inter homines est distributa quam bona mens." Clearness and distinctness of perception, then, are essential to truth, and the difference between clearness and distinctness he explains when he says: "A clear perception I call that which is present and open to the attentive mind, just as we are said to see those objects clearly which are present to the observant eye and move it with sufficient strength and openness. But that perception is distinct which, at the same time that it is clear, is so separated and marked off from everything else that it contains within itself absolutely nothing but what is clear." According to Descartes, the Universe, as created by God, is composed of two substances, Mind and Body. By substance he means anything whose existence is absolute and independent, or at any rate only dependent on the concurrence of God. Bodies and Minds exist, therefore, whether they are present to our consciousness or not, whether they or their properties are perceived by us or not. Each of the two substances has an especial property which constitutes its nature and essence. Extension in length, breadth, and depth constitutes the essence of bodily substance, and it is from our perception of this property that we infer the existence of the substance body. Thought constitutes the nature of the thinking substance or mind, and it is from the existence of his own thoughts that a man infers the existence of his own mind or thinking substance. The other properties of bodies—as figure, motion, position, divisibility—are but modes of the essential property, extension. The other properties of mind—as imagination, sensation, will—are but modes of its essential property, thought. In the case of Man, mind and body are found intimately united; and it is their intimate union that gives rise to many of the feelings we experience: the various appetites, as hunger, thirst, etc.; the passions, as anger, joy, sadness, love, etc.; sensations, as light, color, sounds, smells, tastes, heat, hardness, and other tactile qualities.

To explain how this intimate union of Mind and Body gives rise to these various mental affections was the aim of what justly deserves to be considered his greatest work, his "Passiones sive Affectus Animæ."

He begins this Treatise with a statement of the distinction Philosophers have drawn between Action and Passion. Every occurrence, every fresh event, is called Passion in respect of the subject to which it happens, and Action in respect of the subject which is the cause of its happening. So that, although Agent and Patient are very frequently quite different things, Action and Passion remain one and the same thing, which has these two names on account of the two different subjects to which it can be referred. Now, no subject acts more immediately on the soul than does the body to which it is joined; and, consequently, what is Passion in the soul is commonly Action in the body. There is, then, no safer way of arriving at a knowledge of the Passions than by first carefully considering what is the difference between body and soul, to the end that we may know to which of the two ought to be assigned each one of the various functions that exist in us. For this purpose he lays down the rule that whatever affections and properties are common to ourselves and inanimate bodies ought to be attributed to the body only, as, for instance, figure, motion, heat; all species of thoughts, on the other hand, pertain to the soul. The functions of the body, then—its movements, its heat, the action of its muscles, nerves, brain, and organs of sense—are quite independent of the soul; and it is a vulgar error to suppose that the activities of the body are due to the soul's presence, and that they cease, in other words, that the body dies, because and in consequence of the soul's quitting the body. On the contrary, the soul leaves the body, which is just as much an automatic piece of machinery as a clock, because the bodily machinery gets out of order, gets spoilt, as do the works of a clock. The nature of this machinery he illustrates by an account of the way in which affections of the sensory nerves are converted into muscular movements through the action of the brain and motor nerves, quite independently of the mind—an account which wants but little change to bring it up to the level of the explanation of what is called reflex action, to be found in our text-books of physiology. Indeed, Descartes' conception of the nature of all organized bodies, whether of men or beasts, very much amounts to this: that they are automatic pieces of machinery, so adjusted to their external environment that, when acted upon by this environment, the bodily machinery reacts in a manner conducive to the preservation of its own vigor and efficiency, and, he might have added, to the continuance of the race, co-operating with changes in the environment which are favorable to these ends, and resisting changes that tend to the injury of the bodily machinery or to the extinction of the race; that this action and reaction go on whether the body is endowed with consciousness or not; that beasts of all kinds are probably altogether unconscious automata, and that man is very largely so. But, whatever may be the case with beasts, and Descartes is not quite sure that even they are altogether destitute of consciousness, though certainly they are of reason—*ratione carent et forte omni cogitatione*—man is endowed with a mind to whose action upon the body some of the movements of the latter are due, and whose passions and affections are due to the action of the body upon it.

Cogitationes, thoughts, which are the sole functions of our Soul, are of two kinds. The actions of the Soul, and its Passions or Affections. The actions of the Soul are the activities of our Will; they come from the Soul, and depend upon it entirely. Our Passions are, in general, all kinds of perceptions or thoughts which are found in us (*omnes species perceptionum sive cogitationum quæ in nobis reperiuntur*). The actions of the Will are twofold. They either terminate in the Soul itself, as when we will to think of some intelligible or immaterial object; or they terminate in our body, as when we will to move our limbs and they move. Of our Perceptions, some have the Soul for their cause, others the body. The first class of perceptions are the perceptions of the activity of Will and the perceptions of intelligible as opposed to imaginable things. The perceptions due to the action of our body—that is, the activity of our brains and nervous system—are: 1. Dreams and phantasies due to the brain working in certain tracks left by previous impressions. The phenomena of memory are due to the same cause, except that the Will generally takes an active part in directing the activity of the brain into these traces of ancient impressions left in the brain-substance. 2. The perceptions due to external objects. These objects, affecting our sense-organs, awaken our nerves into activity, and they in their turn awaken the brain into activity, and it is to this activity of the brain that the perceptions of external objects in the mind are due. 3. The perceptions we refer to our body, as heat, cold, pain, etc. Like the last, these perceptions are owing to the affected part of the body setting up activity in the nerves and brain. 4. The perceptions which are commonly referred only to the Soul. The effects of these perceptions are felt as if in the Soul itself, and no immediate cause (*causa proxima*) to which they can be referred is commonly recognized. Such perceptions are the feelings of Joy, Anger, and the like, which are sometimes aroused in us by objects which awaken the activity of our nerves (*e. g.*, external objects or feelings of bodily pain, etc.), and sometimes by other causes. It is to this last class of perceptions to which the word Passions is generally restricted, and it is this class which, under the name of Affections or Passions of the Soul, Descartes undertakes to explain in this Treatise. He shows how these Passions, Affections, or Emotions, like the second and third class of perceptions above, really have their cause in the physical activities of the nerves and brain. Let us take an example, as it will serve most briefly to explain Descartes's ideas on this subject. Suppose an unarmed man to come suddenly across a tiger in a forest. The external object, the tiger, has its image impressed point for point on the retina of the eye, the optic nerve sends to a particular part of the brain impressions each of which corresponds with a particular point of the retinal image. There is thus formed on the brain a physical image or figure corresponding point by point with the tiger, or, at any rate, so much of the tiger as affected the field of vision. Now, this physical image has three effects. First, it produces in the man the same effect as it would in an unconscious automaton, like the antelope. In such an automaton the physical image would affect the nerves leading to the muscles of the legs, and the animal would automatically take to flight, without the intervention of any consciousness or mind in the matter. The second effect of the physical image is the mental image of the tiger which presents itself in the man's soul and makes him believe he sees an actual tiger. The third effect of this physical image is to awaken in the substance of the brain, in ways explained at large by Descartes in his treatise, certain physical activities, the mental aspect of which activities is the Passion or Emotion of Fear. And Descartes explains how the object of these Passions and Emotions is the preservation of the individual, and of the race he might have added. And the way they effect this object is by evoking the activity of the Will and causing it effectually to second the merely automatic efforts of the reflex machinery. Thus, in the example we have chosen, the Emotion of Fear having been roused in the man's mind, he wills to fly. Now, it is only through the Will that the Soul can act upon the body, or rather that portion called the brain. The Will then sets up an action in the brain which, through the mediation of the nerves, sets up an action in the muscles of the legs, or, at any rate, makes them act more vigorously than they would have done automatically. We see, then, that, according to Descartes, all states of consciousness, except those that originate in the Will, have their conditions, origin, or causes in the physical actions of the body, and more immediately of the brain. Either external objects act upon the nerves, or some of the internal organs of the body do so, and this action of the nerves rouses the brain to activity, or in some cases the activity even begins in the brain; well, this Action of the brain, which at the present day we should be inclined to represent by some kind of vibration of its molecules—this aspect of the whole event is the cause of, or has another aspect in, some phase of consciousness, whether perception, emotion, imagination, or what not. In the words of Descartes, what is Action in respect of the Brain substance is Passion in respect of the Mind. "Ita ut quamvis Agens et Patiens sint valde diversa Actio et Passio tamen maneant una eademque res, quæ hæc duo habeat nomina ratione duorum diversorum subjectorum ad quæ referri potest." So that although Agent and Patient—*i. e.*, Body and Mind—in this case are very different, Action and Passion, nevertheless, remain one and the same thing, which has these two names on account of the two different subjects (body and mind again) to which it can be referred. But if, in the cases of consciousness we have been considering, the Actio is in the body and brain, and the Passio is in the Mind, there is another class of cases in which the Actio is in the Mind and the Passio in the brain and body. In this class of cases the Action arises in the Will and terminates in the body, or passes on from it to external matter, whereas in the former class the Action originated in the body, or, if in external matter, it then passed on to the body, and terminated in the Mind. Our Volitions are by Descartes referred to the Mind itself, have the Mind itself and not the body as their cause and origin. Such, in brief, is Descartes' account of the affections of the mind that arise from its intimate union with the body.

The various sensations of color, sound, taste, smell, hardness, softness, and the like—sensations which exist only in our minds, and arise in them owing to the action of external bodies on our bodies and the intimate union of the latter with our minds—are generally considered to be exactly like corresponding properties in the bodies themselves, and are thus placed in the same class with magnitude, figure, motion, and position, properties which exist in bodies independently of our perception, and to which our perceptions accurately correspond. But this is an error, originating in what Descartes considers the prime and especial fountain of all errors—the wrong and hasty judgments we form about things in our earliest infancy, the *præjudicia infantiæ.* At the commencement of life our mind had been so closely bound up with the body that it had no leisure for any thoughts except those only through which it felt the things that affected its body, and even these feelings it did not refer to any external object. It merely had sensations of pain or pleasure according as the body suffered any inconvenience or the reverse; or if the inconvenience or advantage that befell the body was trifling, our mind experienced, according to the diversity of the parts or moods of the bodily affection, the various sensations of tastes, smells, sounds, heat, cold, light, color, and the like—sensations which represent nothing external to thought. At the same time our mind also had perceptions of magnitude, figure, motion, and the like, which were displayed to it as things or modes of things existing external to thought, or, at any rate, capable of so doing, although the infant mind did not yet observe the difference between these two classes of perceptions and sensations. By and by, when the bodily machine, which has been so framed by nature that it can move itself about by its own efforts in various ways, began in a random fashion to twist itself about on this side and that, and in so doing accidentally obtained some advantage or escaped from some inconvenience, the mind adherent to it began to observe that what it so obtained or shunned was external to itself; and not only did it attribute to the external object magnitude, figure, motion, and whatever it perceived as things or modes of things, but also tastes, smells, and the various other sensations which it perceived were caused in it by the external object. And taking account of things only so far as they were of use to the body, the mind considered that the reality of an object was proportional to the degree in which it affected the mind. Hence it thought there was much more substance or corporeity in stones and metals than in water or air, because in the one it felt more hardness and weight than in the other. Nay, so long as it felt neither wind nor cold nor heat in the air, it accounted the air as nothing at all. And, receiving from the stars no more light than from the flames of small candles, the mind imagined the stars not to be larger than those flames. And, not perceiving the rotation and globular shape of the earth, it was inclined to think it motionless and a plane. With a thousand like prejudices was our mind imbued in infancy; and afterward, not remembering that these opinions had never been submitted to a strict examination, it admitted them as most true and most evident.

We have seen that Descartes held that Creation contained only two classes of things, minds and bodies; in other words, that the created Universe was composed of the two substances, Mind and Matter. When, then, in the course of his philosophical system he comes to treat of the material Universe, he has to explain what is the essential nature of the Matter of which it is framed, and how the vast variety of its phenomena are but the consequences of this essential nature. That material objects external to our minds and independent of them really exist, is a truth grounded upon the most certain reasons. Whatever sensation we experience undoubtedly comes to us from something different from our mind; for it does not lie in our power to feel one thing rather than another. This depends entirely on the thing which affects our senses. Now, we have a clear and distinct perception that this thing is a kind of matter extended in length, breadth, and depth, whose various parts are endowed with various shapes and motions, and cause in us a variety of sensations of color, smell, pain, etc. And as we can not believe that God is a deceiver, and causes us to have clear and distinct perceptions of what is false, we are bound to believe that extended objects really exist, possessed of all those properties which we clearly perceive are congruent with extended things. It is this extended thing which is called body or matter. Extension, then, constitutes the nature or essence of any body; not its hardness or softness, or weight, or color, or any other sensible quality. Its nature depends on none of these.

But, if extension is all that constitutes the nature of matter, how is to be explained the phenomenon of rarefaction and condensation, whereby bodies seem to be of different volumes at different times. And, again, where nothing but extension is perceived, it is not usual to speak of body, but to call it empty space, and mere space is believed to be nothing. As to condensation and rarefaction, it is, observes Descartes, a mere change of figure in the condensed or rarefied body, resulting from the nearer approach of its constituent parts to each other, or their removal to a greater distance from each other. If a body of air or water becomes rarefied its quantity remains unaltered, the particles merely move to a greater distance from each other; in other words, the intervening pores become larger, and, as wherever there is extension there is the extended substance called matter or body, Descartes, with perfect consistency, maintains that the increase in the size of the intervals between the parts of the rarefied body is due to the accession of new bodies, although those bodies may be quite imperceptible to our senses. To take his own illustration: when a dry sponge is squeezed, pieces of extension are squeezed out of it, and when the grasp upon it is relaxed, the sponge recovers its shape through pieces of extension making their way into it again. As to the objection to his definition of matter, advanced by those who distinguish between matter and empty space, he observes that it is easy to see that the extension which constitutes the nature of space is the same as that which constitutes the nature of body, if we are careful to attend to the idea we have of any particular body—a stone, for example—and separate everything from it which is not required for its corporeal nature. Its hardness may be rejected, because if the stone is fused or ground into powder it will lose its hardness and yet not cease to be a body. Its color may be rejected, for some bodies are so transparent as to be colorless. Its weight is immaterial; fire, which is exceedingly light, is none the less a body. Its heat or cold or other qualities may also be rejected, because, though they may suffer change, the stone still remains a body. Now, after all these rejections, nothing remains of our idea of the stone except its extension in length, breadth, and depth; the only thing which is contained in our idea of space, whether that space is full of bodies or, as it is called, empty. It follows that there can be no such thing as a true vacuum; wheresoever there is extension there must substance be. *Nihili nulla potest esse extensio.* Hence no vessel filled with any kind of matter can be emptied of that matter without new matter entering as fast as the old matter is got rid of. And should any one ask the question, What would happen if God were to remove the contents of the vessel and allow nothing else to take their place? the answer must be that the sides of the vessel would thereby become contiguous. When nothing interposes between two bodies they must of necessity touch. It is a clear contradiction to suppose there can be distance between them and yet that distance be nothing, since all distance is a mode of extension and therefore cannot exist without extended substance—that is, matter. Hence it follows that a hollow vessel cannot contain more matter at one time than at another, and that, when it is filled with lead or gold or any other heavy or hard body, it contains no more matter or corporeal substance than when it is filled with air or than when it is considered empty. The quantity of matter does not depend on weight or hardness, but on extension only, and this in the same vessel is always the same. From this conception of the nature of matter, Descartes deduces several important consequences. There can be no such things as atoms or portions of matter in their very nature indivisible, since extension itself is divisible without limits. The Universe can have no limits, since we cannot conceive extension as limited. The substance of the earth is the same as that of the heavens, and, however many worlds there may be, they are all made of the same extended substance. Thus in the whole Universe there exists one and the same matter, known by the sole attribute of extension; and all the properties we perceive in it are reducible to the fact that it is divisible and its parts able to move among each other. Hence matter has capacity for all those affections which are perceived to be consequences of the motion of its parts. Every variation in matter, all the diversity of its forms, are due to motion.

According to Descartes, then, not only is all Matter extended, but all extension is Matter. Space is a Plenum; such a thing as a Vacuum is an impossibility. The quantity of Matter contained within any closed surface is the same as the volume of that closed surface. All physical phenomena are to be interpreted in terms of matter and motion; in other words, in terms of extension conceived as capable of division without limits, and with parts capable of motion among themselves.

Let us now examine what Descartes understood by the term

Motion. He is dissatisfied with the common account which takes motion to be the *action* whereby a body migrates from one place into another, as it fails to explain how the same body can be said to be at the same time both in motion and at rest. Thus a man sitting on board a ship sailing out of harbor is in motion with reference to the shore, but at rest with reference to the ship. According to the common notion which places motion in action and rest in the cessation of action, the man ought to be said to be at rest, inasmuch as he feels no action in himself. Descartes therefore gives as a definition of Motion that it is *translatio unius partis materiæ, sive unius corporis, ex vicinia eorum corporum, quæ illud immediatè contingunt, et tanquam quiescentia spectantur, in viciniam aliorum*—Motion is a transference of one portion of matter, or of one body, from the neighborhood of those bodies which are in close and immediate contact with it, and are regarded as at rest, into the neighborhood of other bodies. Now, bearing in mind the fundamental conception that lies at the bottom of Descartes' whole system of physics—namely, that matter and extension are convertible terms, and space consequently a Plenum—we see that the bounding surface of any body must at every point be in immediate contact with some point or points of the bounding surfaces of other bodies, and, according to Descartes' definition, the body is in motion when its bounding surface passes continuously into contact with the bounding surfaces of an ever-changing succession of fresh bodies.

We may form a picture of his idea by observing the motion of a fish as it swims through water. The surface of its body is always in contact with the water, but as it swims along it is continuously passing into contact with fresh watery surfaces. As a moving body can only be in contact with one set of bodies at the same moment, it cannot correctly be said to have several motions at the same time, though, *in thought*, this motion may be considered to be the resultant of any number of motions in different directions. In all cases of motion the difficulty arises of settling which are to be considered the moving bodies and which the bodies at rest, a problem to be solved by considering the circumstances and history of each case as it arises.

But though a body can have only one proper motion of its own, it may share in innumerable other motions. For it may form part of some larger aggregate of matter, having a motion of its own, and that aggregate be but a portion of some still larger body with its own motion, a case we may illustrate by the example of the movements of the wheels of a watch carried in the pocket of a man pacing the deck of a ship sailing upon the surface of our globe as it moves round the sun.

We are now in a position to understand the very important principle which, according to Descartes, governs all actual motions of bodies in the Universe—the principle which forms the foundation of his celebrated theory of Vortices. This principle is that, in every case of motion, a complete circle of bodies moves simultaneously. Since space is a Plenum, a body can only move by expelling some other body from the place into which it enters, and this latter body must expel a third body, and so on, till we come round to a last body, which enters the place left by the first at the moment the first body left it. We can form a mental image of this kind of circular motion by imagining a water-pipe quite full of water, bent round till both ends meet and form a closed ring, within which the water circulates round and round. If, furthermore, we imagine the section of the pipe not to be uniform, it is clear that the smaller the section of any portion of the pipe is, the quicker the water must flow along that part. The same, too, will be the case with Descartes' rings of moving matter. His matter, too, must be capable of indefinite subdivision to be able to accommodate itself to the innumerable varying grades of section of his rings.

When he comes to speak of the cause of Motion, the general cause thereof he makes to be God himself, who in the beginning created matter with motion and rest, and still by his ordinary concurrence preserves in that totality of matter exactly the same quantity of motion and of rest as he then placed in it. For, although in the separate parts of matter the quantity of motion changes, yet is the sum total the same fixed and determinate quantity. Proceeding to discuss particular laws of motion, he succeeds in giving a clear statement of what is called by Newton the first law of motion; but the erroneous and confused account he gives of other cases of motion are of interest only as showing that the human mind had not yet attained the kinematical and dynamical conceptions that the labors of his great successor, Newton, were destined to develop into full clearness and precision.

According to Descartes, the distinction between fluid bodies and hard bodies is that the particles of fluid bodies are moving about in every direction, whereas the particles of hard bodies are at rest. It is because the particles of fluid bodies are in motion that they offer no resistance to pressure, while hard bodies offer resistance to subdivision simply because their particles are at rest. For, he argues, assuredly we can imagine no kind of glue which could hold more firmly together the particles of hard bodies than their own rest. For what could that glue be? Not a substance, because, since the particles are themselves substances, there is no reason they should be joined together by another substance rather than by themselves. There is also no mode different from rest, for no other mode can more oppose the motion which would separate the particles than their own rest. And, besides substances and their modes, we know of no other kind of things. He then, on his own principles, discusses the nature of fluid pressures and motions, and ends the second part of his principles by declaring that the principles laid down in it are sufficient to explain all natural phenomena, as will appear in the following books.

Having laid down the general principles of matter and motion —principles derived from the light of reason, not from the prejudices of the senses—he proceeds to apply them to the explanation of the phenomena of nature. But first he warns his readers against supposing that such finite beings as they are can understand the purposes of God in creation—an error they fall into whenever they say that all things were made by God on our account. In his description of the positions and relative sizes of the bodies that compose our system he places the Sun, which is far the largest, in a fixed position at the centre, where it shines by its own light, while the Moon and other planets, one of which and not by any means the largest is our earth, shine by light borrowed from him. Just as the Sun occupies the centre of a vast sphere in which are the planets only and no fixed stars, so the fixed stars, which are at an immeasurable distance from us, are, each of them, suns shining by their own light and occupying each the centre of a vast sphere of its own. As to the constitution of the Sun, it is a flame of fire made of a highly mobile and fluid matter, that needs no aliment, because its material is not dissipated by the circumjacent matter, as are flames on this earth. Not only do the Sun and fixed stars consist of fluid matter, but all the heavens—he uses the word in the plural because each fixed star is the centre of its own heaven —all the heavens consist of fluid or liquid matter, are plena of fluid or liquid matter, each of which in its motion carries along with it all the bodies, however hard and solid, contained in it. Seeing, then, that our Earth is upheld by no pillars nor suspended by any ropes, but merely surrounded by the highly fluid material of the heaven in which it lies, we ought to think that it is at rest, and has no tendency to motion; nevertheless, we must not think that this fact is any obstacle to its being carried along by that heaven, and, while immovable itself, obeying its movements; even as a ship, impelled by no oars nor winds and bound by no anchors, is at rest in the midst of the sea, although, perchance, some vast body of its waters, gliding along in an unobserved current, may be carrying the ship along with it. In like manner all the other planets are at rest, each in its own region of the heaven, and all the variation of position which is observed in them is merely due to the fact that all the material of the heaven which contains them is in motion. And here Descartes reminds the reader that what he has just said about the earth and planets being at rest is entirely in accordance with, and follows from, his own definition of motion—namely, that it is the transference of one body from the neighborhood of the bodies which are in immediate contact with it and are regarded as at rest into the neighborhood of other bodies. With such a definition of motion it is easy to see how Descartes could uphold the earth's immobility.

Descartes' reasons for considering the Earth at rest are highly interesting. They show us how he succeeded in reconciling his science and his orthodoxy. Well may he pride himself when he compares his own skill in avoiding Copernicus's error of attributing motion to the earth with the clumsiness of Tycho Brahe, who verbally denied the earth's motion, but really attributed more movement to it than Copernicus himself. Had poor Galileo known of Descartes' definition of motion, he might have evaded the censures of the Church, defied the Inquisition, and yet held to his own views of the Solar System. Having thus removed every scruple on the subject of the earth's motion, Descartes tells us that we should think that the whole material of the heaven wherein the planets abide is perpetually whirling round after the fashion of a vortex, with the Sun in the centre, and that the parts of the heavenly material nearer to the Sun move more rapidly than the more remote, and that all the Planets (one of which is the Earth) always abide within the same portion of the celestial material. In this way, without the aid of any machinery, may all their phenomena be most easily understood. For, just as when straws float on the surface of an eddy or whirlpool in a river, we see that they are carried along by it, and some even turn round their own centre, and that the nearer they are to the centre of the eddy, the quicker they complete a whole gyration, and that although their motions are always circular, yet they scarcely ever describe absolutely perfect circles, but deviate a little therefrom in length and breadth, so can we, without any difficulty, imagine all the same things concerning the Planets. And by this one thing are all their phenomena explained. Those planets that have satellites revolving round them he considers to occupy the centre of minor vortices contained in the greater vortex, whose centre is the Sun. Thus the Earth is the centre of a subordinate Vortex, which not only serves to carry the Moon round in her monthly course, but also carries round with it the earth in every twenty-four hours; and thus we see that, as in the case of the Earth's annual motion round the Sun, Descartes could maintain that the Earth was at rest, so, in spite of its daily revolution round its own axis, he can once more uphold the doctrine of its immobility.

As regards the Matter that fills the Universe, Descartes supposes that as originally created by God it consisted not of spherical parts, as with such a shape they could not have constituted a Plenum, but of parts with angles or corners. These parts, being in motion, were gradually ground into a spherical shape, and the corners thus rubbed off (like filings) form an exceedingly fine and subtle matter—Descartes' first element—which fills the interstices between the spherical portions, which are likewise very minute, and constitute his second element. There is besides a third kind of matter of parts more coarse and less fitted for motion. This is his third element. Of the first element are made the sun and the fixed stars; of the second, the transparent substance of the skies; and the third is the material of opaque bodies, as the earth, planets, and comets. As the material Plenum gradually shapes itself into vortices, the first element collected at the centre of each vortex forming the sun and stars, the second element formed the great body of each vortex, surrounding the central element on every side, and, by the pressure caused by its centrifugal effort as it whirls round and round, it constitutes light. The planets are carried round the sun by the motion of his vortex, each planet being at such a distance from the sun as to be in a part of the vortex suitable to its solidity and mobility. The motions are prevented from being quite circular and regular by various causes; a vortex, for instance, may be pressed into an oval shape by contiguous vortices. Comets are free to glide out of one vortex into the next contiguous one, and thus to travel, in a winding course, from system to system, through the universe. Such is a brief sketch of Descartes' system of the Heavens. It is worked out in all its details in the third book of his "Principia," and it is impossible not to be struck by his extraordinary ingenuity in making it account for the very large number of phenomena to which he applies it in that book. Three phenomena, however, three laws of planetary motion, well known in Descartes' time, he does not account for, passes over in total silence, as though they were facts of no moment; and it was his neglect to account for these three laws that caused his "Principia" to be superseded by the "Principia" of his great successor Newton, who did account for them. The laws referred to are, of course, the celebrated ones discovered by Kepler: that the planetary orbits are ellipses with the Sun in a focus; that the areas described or swept out by lines drawn from the Sun to the planet are proportional to the times of describing them, and that the squares of the periodic times of the planetary revolutions round the Sun are as the cubes of their mean distances from him. These laws Descartes passes over in silence. It is impossible to suppose he had no knowledge of them. Kepler had published his discoveries as early as 1609. Descartes, moreover, shows his familiarity with the works of Tycho Brahe, who was Kepler's fellow-laborer at Prague. Whatever the cause of his neglecting to take these laws into account, that neglect ensured the rejection of his theory of the solar system, when Newton advanced his theory accounting for them. Should, however, the law of gravitation ever be successfully explained by a system of stresses in an all-pervading fluid, Descartes' theory, though in a form much modified and altered, might again reign within the realm of Science.

A POPULAR STATEMENT OF IDEALISM.

BY WILLIAM M. SALTER.

I.

The object of this paper is not so much to prove idealism as to state it with a measure of clearness and consistency. If there is at times an undue positiveness of statement, let it not be charged to an intention of lording it over the reader, but simply to a desire to thoroughly enter into and speak from the intellectual standpoint under discussion. Further, the sciences of physics and physiology, ordinarily regarded as having a more or less materialistic tendency, are in truth, at the present time, rather inclining to play into the hands of the idealist.[1] We shall not, however, presuppose a technical knowledge of these sciences on the part of the reader, as we lay claim to no such knowledge for ourselves, and hence shall, from necessity as well as choice, abstain from any extended use of their technical phraseology. Without further preface, then, we may begin.

When the thorns of a rose-bush prick our finger, we have as a result a pretty recognizable feeling, called pain. It is a real sensation, and we may localize it in the finger, yet we do not attribute it to the thorns and say that it exists in them. We know very well that as our sensation it cannot exist apart from ourselves, and so we call it a subjective reality. Suppose, now, that we bend over to smell one of the roses on the bush; we are greeted with a new experience of a more agreeable character, viz., perfume. Is this perfume a reality outside of us, or a sensation of our own?

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[1] W. K. Clifford even says that the "doctrine of Berkeley's has now been so far confirmed by the physiology of the senses that it is no longer a metaphysical speculation but a scientifically established fact." ("Right and Wrong.")